Geophysical Research Abstracts, Vol. 7, 00303, 2005
SRef-ID: 1607-7962/gra/EGU05-A-00303

Current density measurement in space - methodology and instrumentation

V. Korepanov, R. Berkman, F. Dudkin
Lviv Centre of Institute of Space Research (vakor@isr.lviv.ua/+380322639163)

The direct measurements of spatial current density (SCD) in plasma is not solved problem for space instrumentation till now. The importance of such information is very high: as the calculations show, simultaneous measurements of orthogonal components of SCD and magnetic field fluctuations in one point allows to calculate k vector of propagating electromagnetic plane wave and to discriminate spatial and temporal variations onboard of sole satellite.

Some attempts to build the instrument for such measurements and to execute them in situ are known. Most of them were not successful because of strong influence of secondary factors (e. g., strongly masking the measured value, but these attempts are nevertheless still continued.

At present, two different methodologies for SCD study are developed: differential contacting of space plasma with the help of split Langmuir probe (SLP) and contactless observation of the integral current flux through the given window area, realized with the help of Rogovsky coil (RC). Both these methodologies are discussed in the report and recent progress in the field is presented.

For SLP, an intensive theoretical study showed its practical ability to measure the SCD. To prove this, the physical modeling was performed, using laboratory chamber where ionospheric plasma was simulated and corresponding currents, which imitate real ones in the ionosphere were created. The tests results confirmed theoretical postulates, SLP transfer function “SCD - output voltage” was obtained for low frequency band (1 Hz - 40 kHz) and sensitivity limits were determined.

Also both theoretic and experimental study of RC operation was performed. First, the main source of RC error was revealed - the external magnetic field variations -

and then the experimental study confirmed high RC sensitivity to the magnetic field, which makes RC application for SCD study practically impossible. The ways to avoid this kind of errors is discussed. Finally, first results of both SLP and RC application in space experiments are presented.